Rock Chips
Fall/Winter 2003

Mission: Provide the geoscience information and expertise needed by government, industry and the public for earth resources stewardship and sustainable development.

Alberta Geological Survey

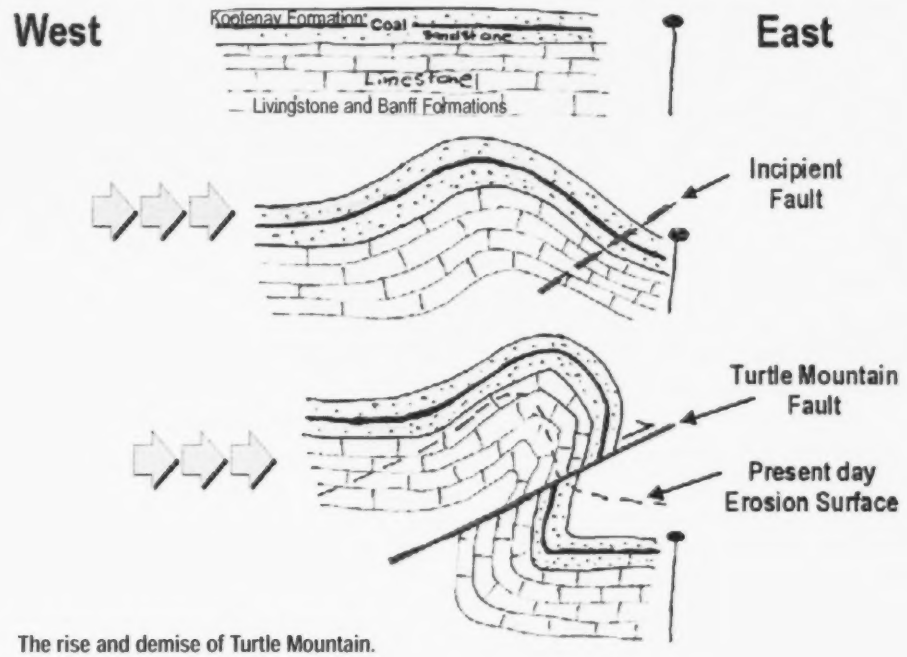
Implementation of a State-of-the-Art Monitoring System on Turtle Mountain

On April 29th, 2003, during the Centennial remembrance ceremony for the disastrous Frank Slide, Premier Ralph Klein announced that the Province of Alberta would commit to implementing a state-of-the-art monitoring system for Turtle Mountain at a cost of $1 million dollars. AGS is providing geological technical expertise towards implementing this monitoring system.

AGS provided geological background data for a new documentary produced for the Frank Slide Interpretive Centre called 'On the Edge of Destruction,' as well as for a book with the same title. The documentary was shown on Access TV in April 2003.

Three hundred million years ago, the area that is now the Crowsnest Pass lay at the bottom of a shallow ocean. Sea creatures lived and died in the warm water. Their bodies drifted to the bottom, building thick layers of calcium carbonate that compressed into limestone. Geologists named these rocks the Livingstone and Banff formations, where the Banff is distinguished from the Livingstone Formation by consisting of shaly limestone instead of pure limestone.

Gradually the sea dried up, exposing a vast area with rivers draining into huge deltas. Vegetation grew and



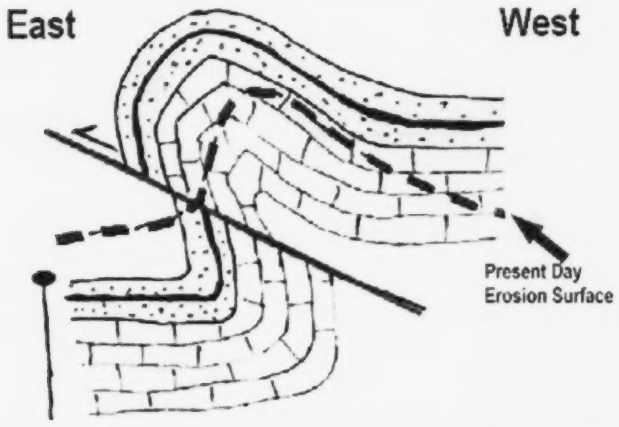
The rise and demise of Turtle Mountain.

EUB Alberta Energy and Utilities Board
AGS

died, sinking into the swamps and creating layers of organic material that gradually compressed into coal. Wind and water laid down still more layers of sand, silt and mud, each to be buried and compressed in their turn, forming sandstone, siltstone and shale. Geologists named these rocks (including coal) the Kootenay Formation.

Sixty million years ago the land began to shift and buckle, resulting from the movement of plates that constitute the Earth's crust. These immense compressing forces caused the layers of limestone, sandstone, shale and coal to fold and break, and raise these rocks to form the Rocky Mountains.

The layers of limestone, sandstone, shale and coal that would become Turtle Mountain were folded upward into an arched "A-frame" shape. At first, the layers were squeezed into a gentle fold (called the Turtle Mountain Anticline). The pushing increased and a fault (breakage of rocks) developed under the fold. This fault is called the Turtle Mountain Fault. The part of the folded layers above the fault separated from the rocks beneath, and slid eastward on the fault surface. Eventually folded limestone layers rode over top of almost vertical sandstone, shale and coal layers. This structure can be viewed from the Frank Slide Interpretive Centre.



The view from the Interpretive Centre (reversed from the previous diagram).

The layers on the east side of the steeply sloped mountain are like slippery playing cards stacked one atop another; and as a result, they are prone to sliding down the mountain. The 1903 Frank Slide event was a result of this instability.❖

Rock Chips is published twice yearly by the Alberta Geological Survey, in the spring/summer and the fall/winter.

Past and present issues of *Rock Chips* may be viewed on the AGS Web site www.ags.gov.ab.ca.

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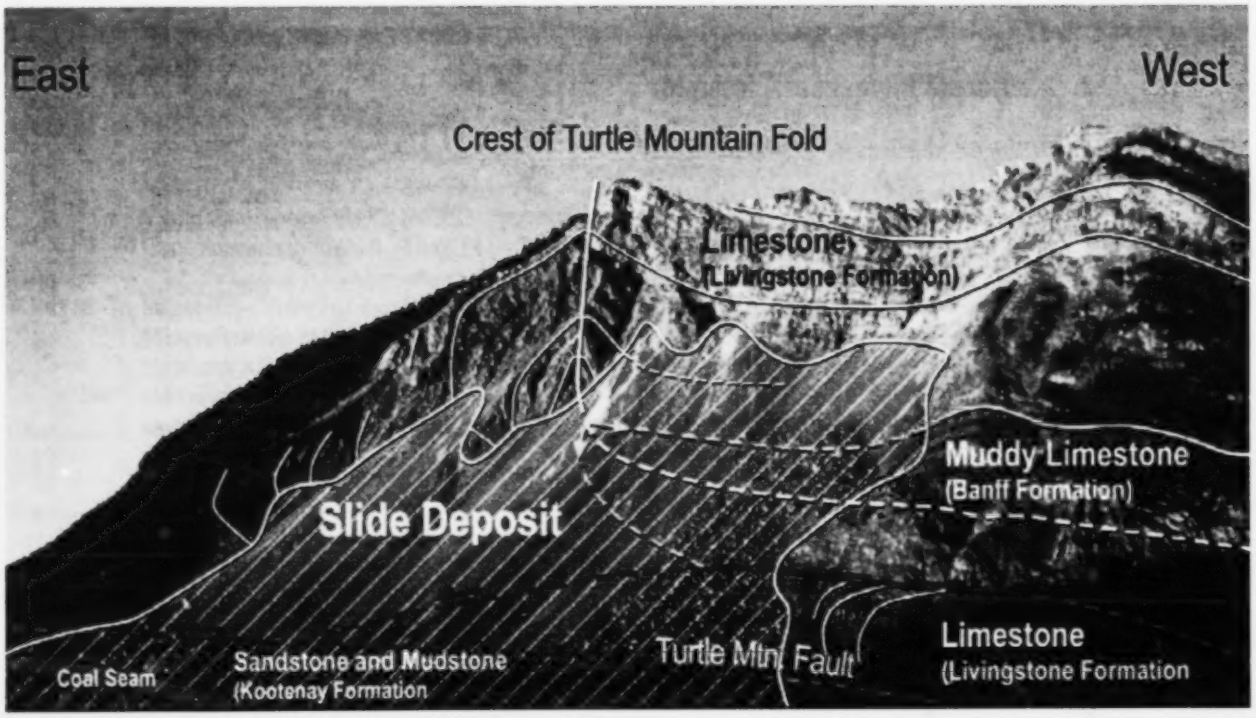
The view from the Interpretive Centre.



View from the Interpretive Centre showing geological interpretation.

Recently Released AGS Publications

Earth Sciences Reports

ESR 01-05 Major- and Trace-Element Geochemistry of Kimberlitic Rocks in Northern Alberta. 10.9 MB PDF. $20.00.

ESR 01-06 Three-Dimensional Geometry of Fluvial-Estuarine Oil Sand Deposits of the Clarke Creek Area (NTS 74D), Northeastern Alberta. 15.4 MB PDF. $20.00.

ESR 03-03 Production Potential of Coalbed Methane Resources in Alberta. 10 MB PDF. $20.00.

ESR 03-04 Chemical and Physical Hydrogeology of Coal, Mixed Coal-Sandstone and Sandstone Aquifers from Coal-Bearing Formations in the Alberta Plains Region. 4.95 MB PDF. $20.00.

Geo-Notes

GEO 02-04 Arsenic Concentrations in Quaternary Drift and Quaternary-Tertiary Buried Channel Aquifers in the Athabasca Oil Sands (In Situ) Area, Alberta. 2.75 MB PDF. $20.00.

GEO 02-14 Sedimentology and Stratigraphy of Middle and Upper Devonian Carbonates in Northern Alberta: A Contribution to the Carbonate-Hosted Pb-Zn (MVT) Targeted Geoscience Initiative. 1.78 MB PDF. $20.00.

GEO 02-15 Structural Control of Lead-Zinc Mineralization in Carbonate Sequences of Northern Alberta: A Contribution to the Carbonate-Hosted Pb-Zn (MVT) Targeted Geoscience Initiative. 4.63 MB PDF. $20.00

GEO 02-19 The Carbonate-Hosted Pb-Zn (MVT) Project for Northern Alberta - Background and Year One Summary: A Contribution to the Carbonate-Hosted Pb-Zn (MVT) Targeted Geoscience Initiative. 1.23 MB PDF. $20.00.

GEO 02-20 Metallogenic Considerations for Devonian Carbonates in the Fort McMurray and Fort Vermilion Areas, Alberta: A Contribution to the Carbonate-Hosted Pb-Zn (MVT) Targeted Geoscience Initiative. 2 MB PDF $20.00.

GEO 02-21 Controls on Fluid flow Systems in Northern Alberta as Related to MVT Mineralization: A Contribution to the Carbonate-Hosted Pb-Zn (MVT) Targeted Geoscience Initiative. 8.42 MB PDF. $20.00

GEO 02-22 A GIS Summary of Field Data Gathered During Year One (2001) of the Carbonate-Hosted Pb-Zn (MVT) Project for Northern Alberta: A Contribution to the Carbonate-Hosted Pb-Zn (MVT) Targeted Geoscience Initiative. NOTE, this CD can only be viewed if you have ArcView 3.2a on your computer.

GEO 03-11 Orthorectified and Principal Component RADARSAT-1 Image Dataset for NTS 73M, Alberta. 4.42 MB PDF report and various other files, 2 CD set. $25.00

Mineral Assessment Reports

MIN 20020001 Assessment Report Bighorn Project, 18 pages.

MIN 20020002 Athabasca Metallic and Industrial Minerals Permits, Northeastern Alberta. 2523 pages and 19 maps.

MIN 20020003 2001 Exploration for High-Calcium Limestone at Clearwater and Limestone Ranges of West-Central Alberta. 21 pages and 5 maps.

MIN 20020004 Calling Lake Project, Alberta 1999 - 2000 Exploration and Drill Program Summary. 61 pages and 2 maps.

MIN 20020005 McIvor Property Report on Alluvial Sampling and Mineral Testwork. 95 pages and 1 map.

MIN 20020006 Assessment Report for Alberta Metallic and Industrial Minerals Permits Numbers 9398030062-65, 9398030094-95 Clear Hills Area, Alberta. 16 pages.

MIN 20020007 756736 Alberta Limited 2000 - 2002 Exploration of the Saulteaux Block Property North-Central Alberta. 36 pages.

MIN 20020008 756736 Alberta Limited 2000 - 2002 Exploration of the Driftwood Property North-Central Alberta. 25 pages.

Special Reports

SPE 21 Structural Interpretation of RADARSAT-1 Principal Components Imagery and Its Potential Application to Kimberlite Exploration in the Buffalo Head Hills Area, North Central Alberta. 60.4 MB PDF. $20.00

SPE 54 An Investigation of Geological Applications of Archival Lightning Strike Data in the Province of Alberta (North of Latitude 54° North). 11.9 MB PDF. $20.00.

SPE 56 Catalogue of Selected Regional Gravity and Magnetic Maps of Northern Alberta. 18.7 MB PDF. $20.00

SPE 61 Phases 1 to 4 Extech IV Study of the Early Proterozoic Athabasca Group, Northeastern Alberta. 7.1 MB PDF. $20.00.

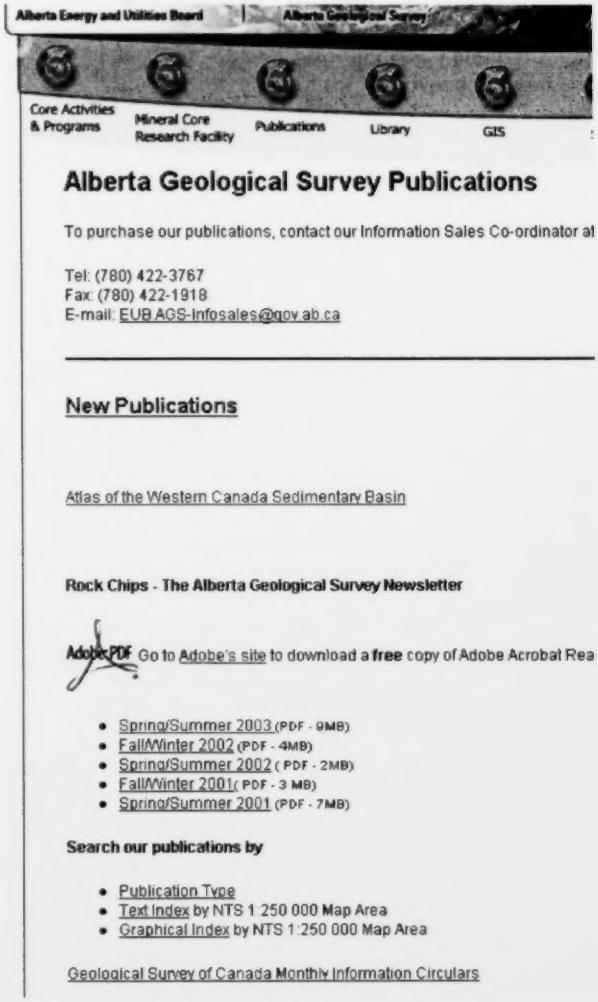
(The following groundwater report is sold on behalf of the Prairie Farm Rehabilitation Administration (PFRA). Please contact them for further information.

SPE 67 Regional Groundwater Assessment - Final. 457 MB. 2003. $20.00

Further information on these or other AGS publications may be found on the AGS Web site at

http://www.ags.gov.ab.ca/

Click on the Publications link and the following page will appear. From this page you may view the Rock Chips newsletter in PDF form or search for publications by publication type, a text index or a graphic index.



Story Contact Information

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Rock Walk of Downtown Edmonton	Dixon Edwards	(780) 427-1516

They may also be contacted via e-mail by entering the author's first name.last name@gov.ab.ca

Geographic Information Systems Launches on the AGS Web Site

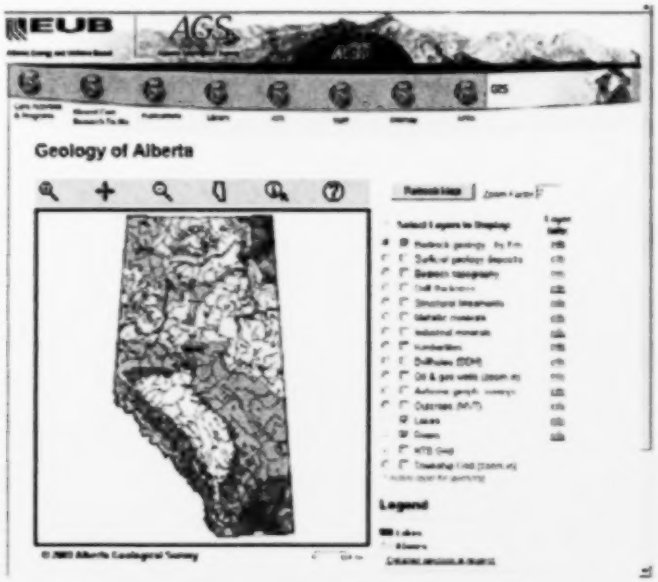
AGS is implementing a simple, geographic information systems-based (GIS) site for browsing and downloading selected GIS data (click on the 'GIS' link on our home page at http://www.ags.gov.ab.ca/). The site is being developed using MapServer, an Open Source, public domain software developed by the University of Minnesota (see http://mapserver.gis.umn.edu/ for more info). Three interactive maps will be available showing general Alberta geology, AGS RADARSAT-1 data holdings and hydrogeology/water well chemistry. The maps will link to other useful information such as core photos, thin section photomicrographs, drillhole logs, print-ready maps and related AGS publications. More thematic interactive maps are also in the plan as newer project data become available and as older datasets are audited, cleaned and spatially enabled.

Home page for the GIS Web site on the Alberta Geological Survey Web site.

The maps will show the following contents:

Alberta geology

- Bedrock geology (1:1 000 000);
- Surficial geology deposits (1:500 000, south and central Alberta);
- Bedrock topography (1:2 000 000);
- Drift thickness (1:2 000 000);
- Structural lineaments compiled from literature studies of northern Alberta;
- Metallic mineral occurrences (Phanerozoic, north of 55° N);
- Industrial mineral occurrences;
- Kimberlite locations;
- Drillholes (northeast Alberta);
- EUB oil and gas wells;
- Airborne geophysical surveys; and
- Outcrops (selected project areas)

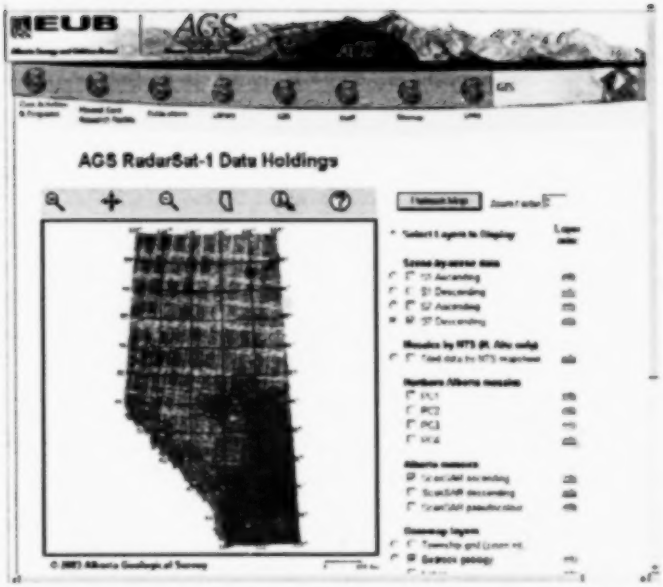


Interactive map showing the general Alberta geology Web site.

RADARSAT-1 Data Holdings

As part of its strategy to map the surficial and structural geology in northern Alberta, the AGS acquired RADARSAT-1 satellite imagery in 1999 for all of northern Alberta (i.e., between 55° N and 60° N latitude). These data have been orthorectified and tiled to NTS maps areas, and soon will be available for purchase through our Information Sales office. Resampled versions of the imagery will be able to be viewed and downloaded on the GIS Web site, and simple maps can then be made for printing. Users of AGS RADARSAT-1 data holdings will be able to

- View orthorectified scene images for standard beam modes 1 & 7, ascending & descending;
- View, download (GeoTIFF) or print a simple map of NTS map areas of
  - Orthorectified tiled images of standard beam modes 1 & 7, ascending & descending,
  - Principal components 1, 2, 3 & 4, plus pseudocolour composites;
- View northern Alberta mosaics of principal components 1, 2, 3 & 4;
- View Alberta mosaics of
  - ScanSAR narrow ascending;
  - ScanSAR narrow descending; and
  - ScanSAR narrow composite.

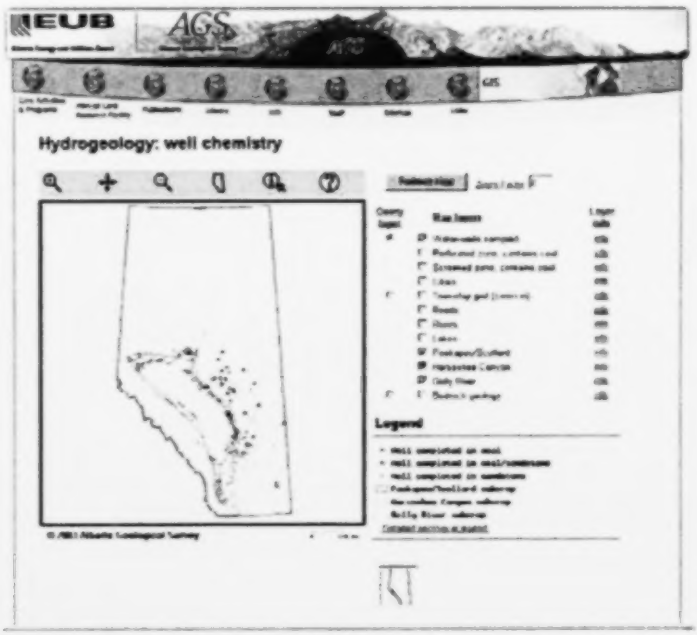


Interactive map showing the AGS Radarsat-1 Data Holdings Web site.

Hydrogeology - Well Chemistry

Users will be able to browse high-quality chemical analytical data for water well samples collected within shallow coal-bearing aquifers in the Alberta Plains Region. These samples were collected to evaluate the alternative disposal or beneficial uses of coalbed methane (CBM)-produced waters, in support of CBM development.

AGS is committed to continually improving and enhancing its GIS data content for distribution to the public. Plans include adding more GIS functionality using ESRI's ArcIMS® software, which we will phase in over the next year. We encourage our readers to check out the site and we welcome any feedback at EUB.AGS-Webmaster@gov.ab.ca.❖

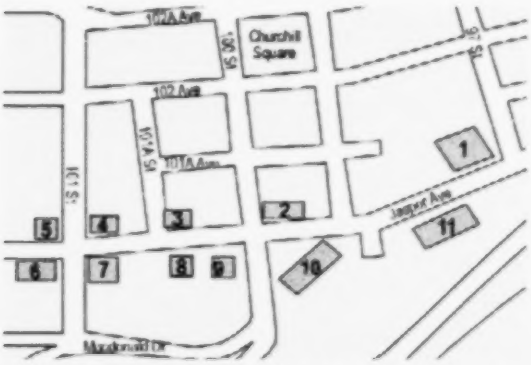


Interactive map showing the AGS hydrogeology/water well chemistry Web site.

A Rock Walk Through Downtown Edmonton

A rock walk is a stroll along the sidewalks of downtown Edmonton and the opportunity to see the amazing suite of minerals and rocks on display in the building stone and rock materials of the city structures. The information for this rock walk was assembled through a comparison with similar rocks in hand, from other geologists and masons, from referenced publications and, in a very few cases, from the analysis of actual pieces of the building stone.

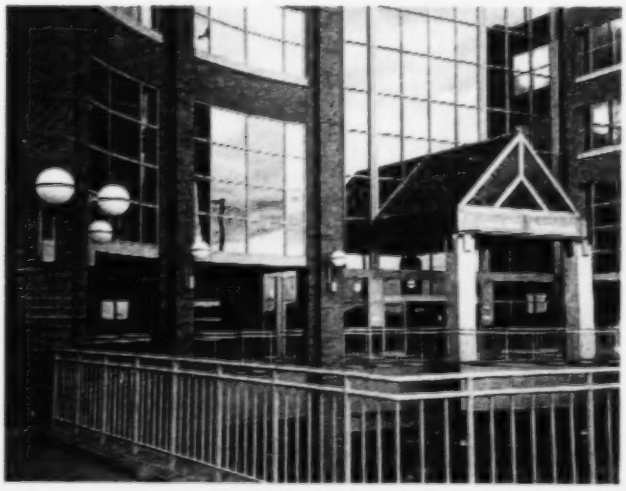
The following are some of the buildings and sites that you see as you do a rock walk through downtown Edmonton. The next time you are standing on the corner waiting for the lights to change, have a look at the building near you.

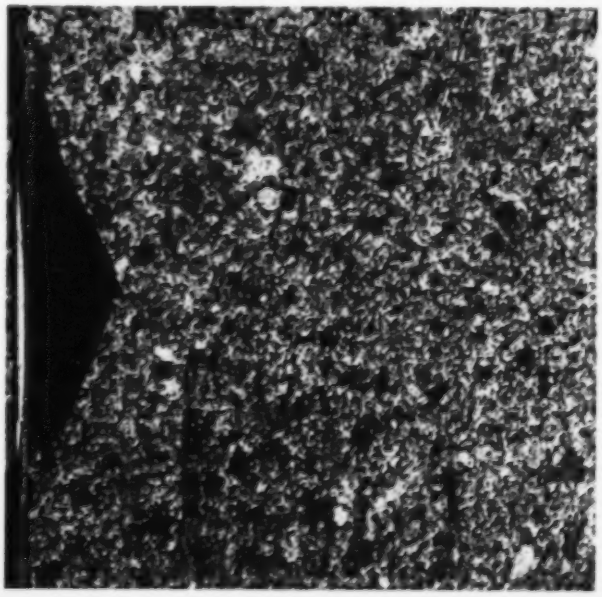


Map of downtown Edmonton (not to scale) outlining some of the buildings on the rock walk.

Very attractive, polished pink granite, trade name Rosa Sardo, is used for the fountains and benches in Canada Place (building number 1). The granite is composed of light grey quartz, large pink or flesh-coloured feldspars, white plagioclase feldspar and black mafic minerals.

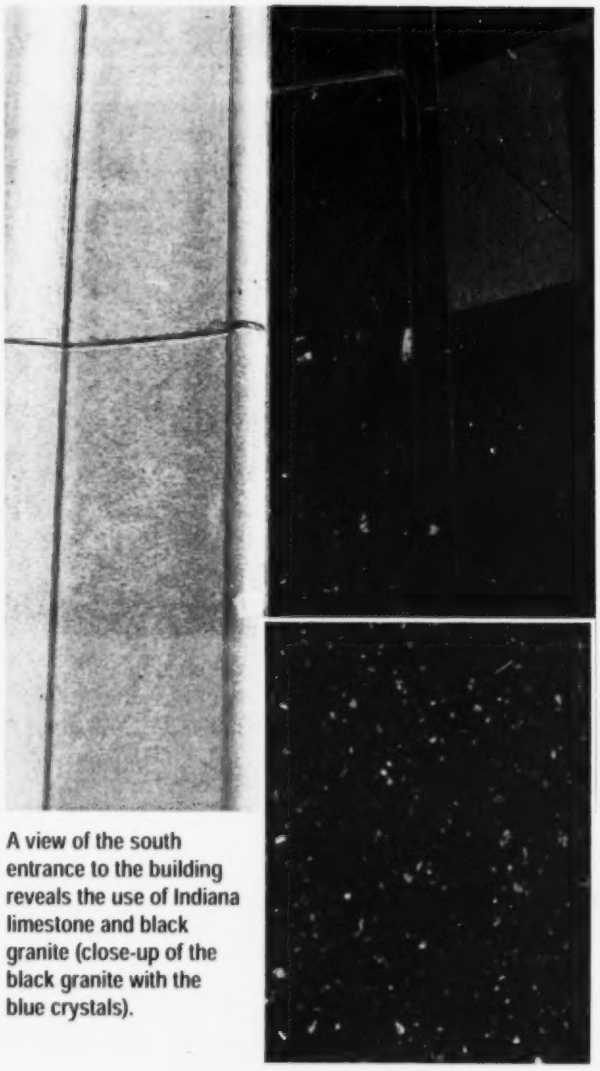
Fired granite is used on the walkways and the floor. The same fired granite is used on the outside sidewalk.



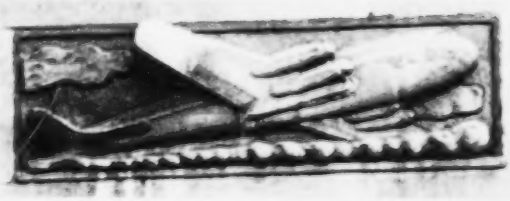


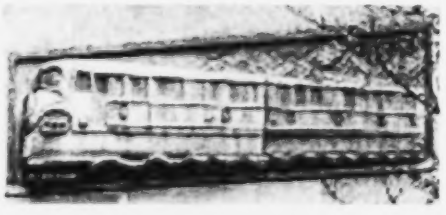
The former Imperial Bank of Canada (number 2 on the map), first opened its doors at this site in 1891. In 1950, the building was demolished, to build a larger structure. However, due to a shortage of structural steel, construction was delayed until 1952. You may note the relief panels, which show trains and planes, the metal spandrels with the bank's logo, as well as the quoins and pilasters stylized as bands of rectangles. (Historical Walking Tours of Downtown Edmonton, 1995).

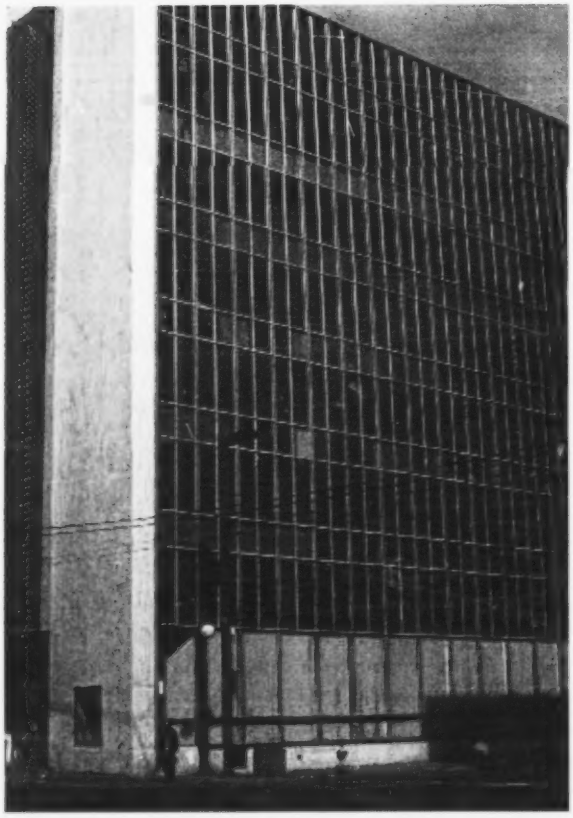
The building stone and rock materials consist of fossiliferous Indiana limestone and black granite. The black granite consists primarily of feldspar. A closer look at the black granite will reveal brilliant flashes of blue as the light changes on them.



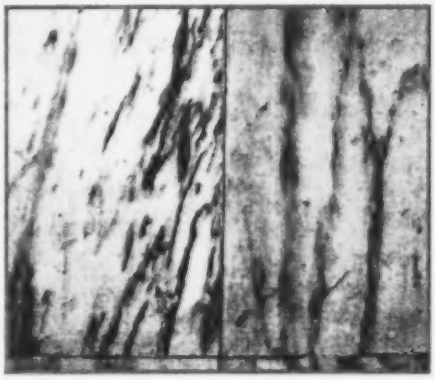
A view of the south entrance to the building reveals the use of Indiana limestone and black granite (close-up of the black granite with the blue crystals).





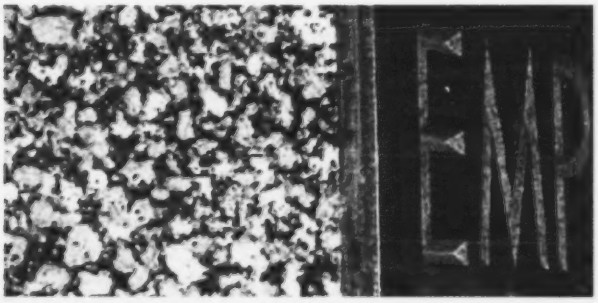


Number 3 on the map is the Toronto-Dominion Bank Building at 10004 Jasper Avenue. It is made with one of the world's most common building stones—marble. This particular building is made with Carrarra marble from the Carrara region in northwest Italy.

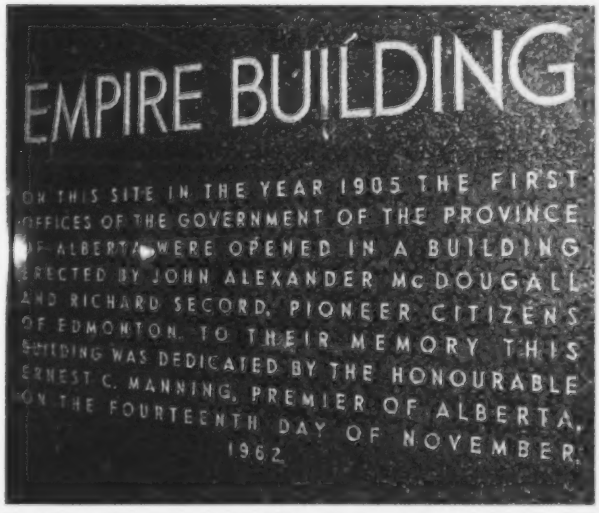


Marbles of commerce (rocks with the trade name of marble) include true (geological) metamorphic marble, polishable serpentine rocks (verd antique) and certain crystalline limestones. Carrarra is a fine-grained marble with a mosaic of calcite crystals 0.1 to 0.3 mm in size. The marble is 97% calcite with minor feldspar and mica particles.

Pink and black granite are the dimension stones used for the Empire Building, number 4 on the map. The pink granite is very coarse-grained with large pink crystals of feldspar.



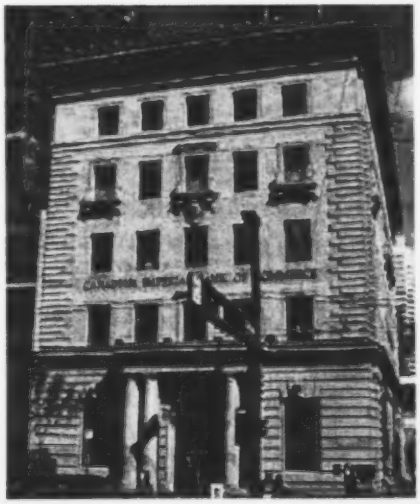
A much finer grained black granite is used on the entrance on the east end of the building. The history of the Empire Building is carved into this black granite.



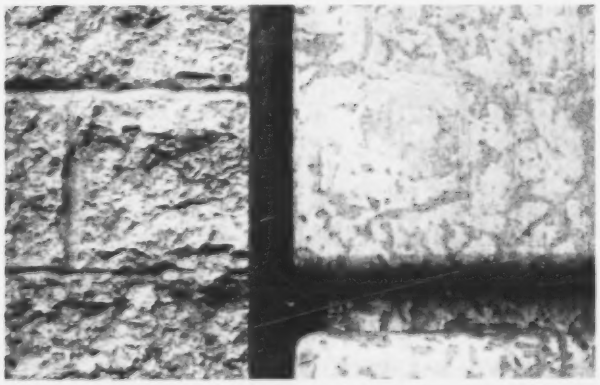
Igneous, Metamorphic and Sedimentary

The corner of Jasper Avenue and 101 Street contains buildings constructed with the three major rock types (igneous, metamorphic and sedimentary). The CIBC on the northwest corner represents the sedimentary group as it is constructed with Tyndall limestone (Tyndall Stone). The Royal Bank on the southwest corner represents the igneous group as it is constructed using brown granite. The former Bank of Montreal on the southeast corner represents the metamorphic type as it uses gneiss.

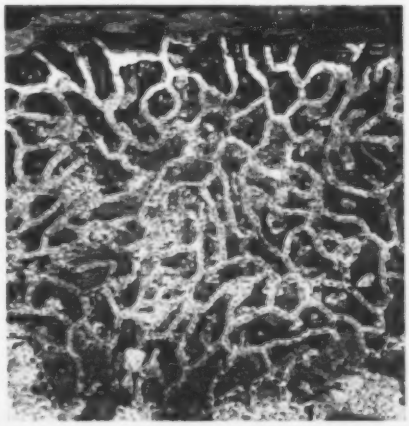
The building stone in the CIBC building (number 5) is Tyndall limestone. This limestone is quarried approximately 30 km northeast of Winnipeg, Manitoba, at Tyndall and Garson, Manitoba. It has been used since 1832 (e.g. Fort Garry). Tyndall Stone is limestone (light colour) with dolomite (darker colour) in the irregularly shaped burrows of ancient marine worms. The limestone is 250 million years old (Upper Ordovician).



The outside of the building uses various cuts of the Tyndall Limestone. A close-up look at the walls will reveal many interesting fossils embedded in them.



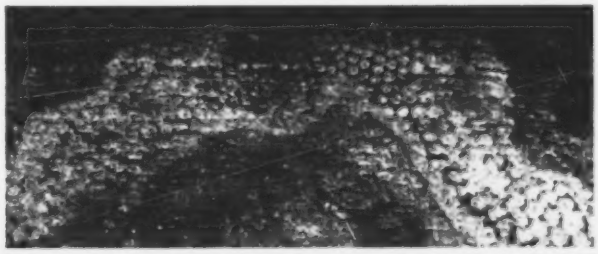
Cephalopods are represented very well in the rock. These are like modern squids or nautili. The ones with a straight shell are *Orthocone* cephalopods and the ones with a curved shell are *Winnipegoceras*.

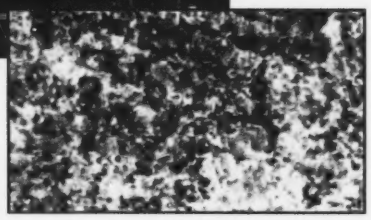


True corals are well represented in the rock as well. The 'chain coral' is appropriately named. Upon a closer look, you will see the pattern in the rock is a series of interlinked chains (*Favosites*).

The 'horn coral' is a solitary coral. In the rock the fossil has a pattern of lines radiating out to an oval or horn-like pattern (*Grewingka*).

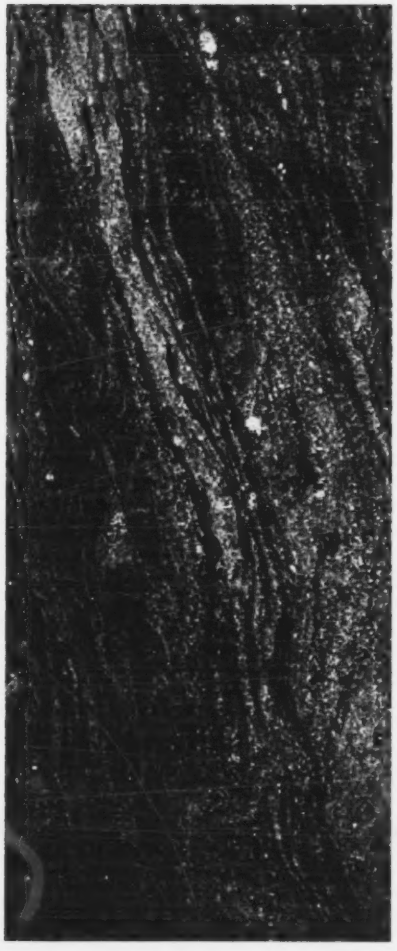
'Sunflower coral' is typical of Tyndall Limestone. It is actually an alga. The fossil is characterized by a uniform grid pattern and a distinguishable deep hollow in the center (*Receptaculites*).





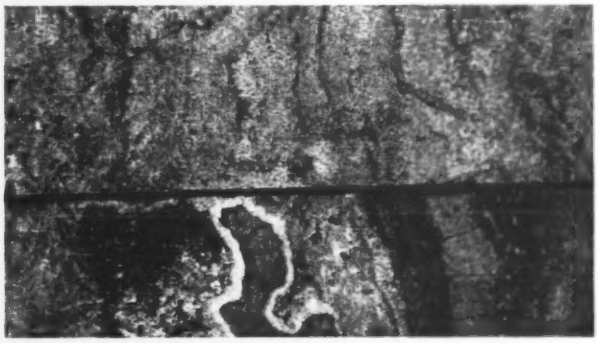
Igneous rock is represented in the 6th building on the tour, the Royal Bank building consisting of brown granite (Dakota Mahogany). This building stone is a medium-grained granite that can be brown, blue or pink depending on the light. The quartz crystals look like blue 'eyes' in the rock.

The 7th building is the former Bank of Montreal building. Dimension stone slabs are cut from large blocks of Morton Gneiss. This gneiss comes from Minnesota and is believed to be 3.6 billion years old. The large dimension stone panels are arranged to create a matching pattern on the side of the building. Each slab is cut from a large block and is usually less than 1/2 inch thick. The 'flow' of various materials in the development of the gneiss is clearly visible throughout the panels on the building.



The outside facing entry of the Paladium Club, number 8, is a soft travertine (spring deposit), probably from Bari, Italy. The rock is about 100 million years old. It forms when algae grow in nutrient-rich pools and trap calcite crystals to form layers. As the layers are buried, the algae suffocate, die and decompose, forming gas bubbles that are preserved as the holes you see between the layers.

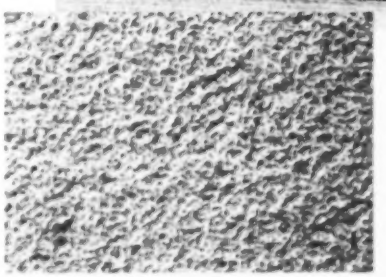
The holes in the travertine are plugged with epoxy to make the rock more resistant to weathering. Occasionally you see rock with the holes left open.

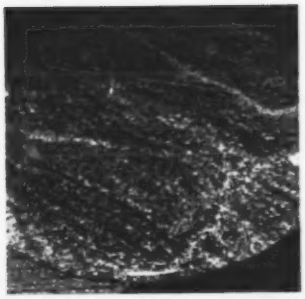


In front of the box office there is a red rock with a crest. This rock is red granite and uses both polished and unpolished granite.

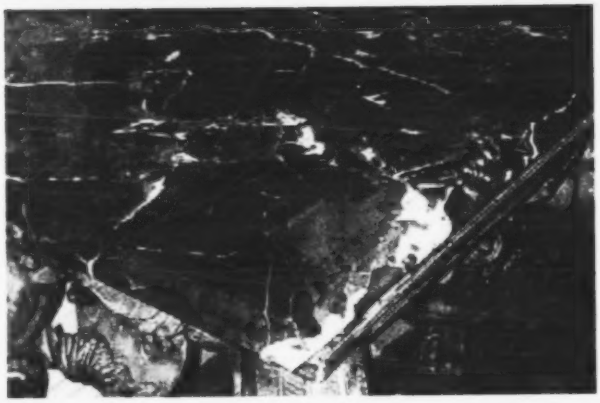
Number 9 on the map, the Union Bank, is the only pre-World War I bank building remaining in downtown Edmonton. The facade of local pressed brick and Indiana limestone conceals a modern, fireproof, steel and brick structure.

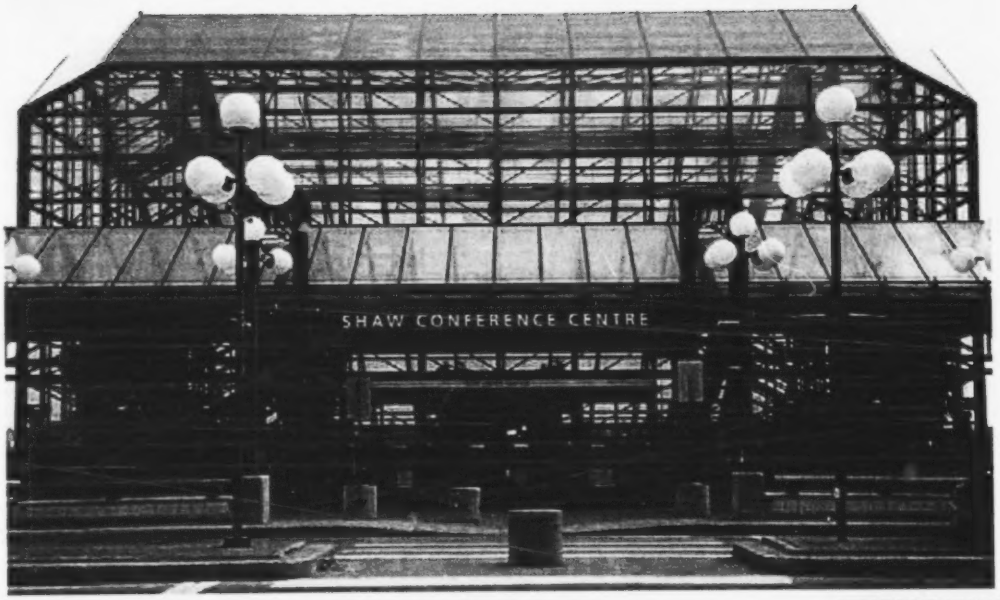
The surface on the front of the building is rough because the rock is composed of small fossils. The rock is made of the mineral calcite and is quite soft. Although the rock is soft, it is tough, easy to saw and makes a great building stone. This limestone is found in many of Edmonton's older buildings.



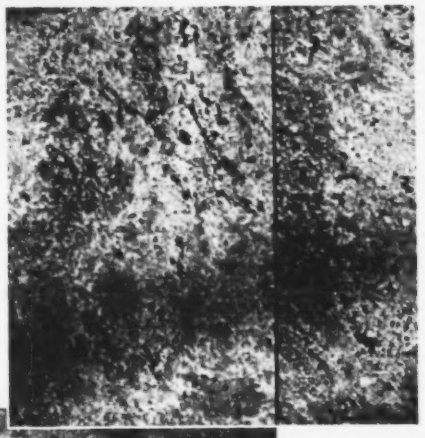


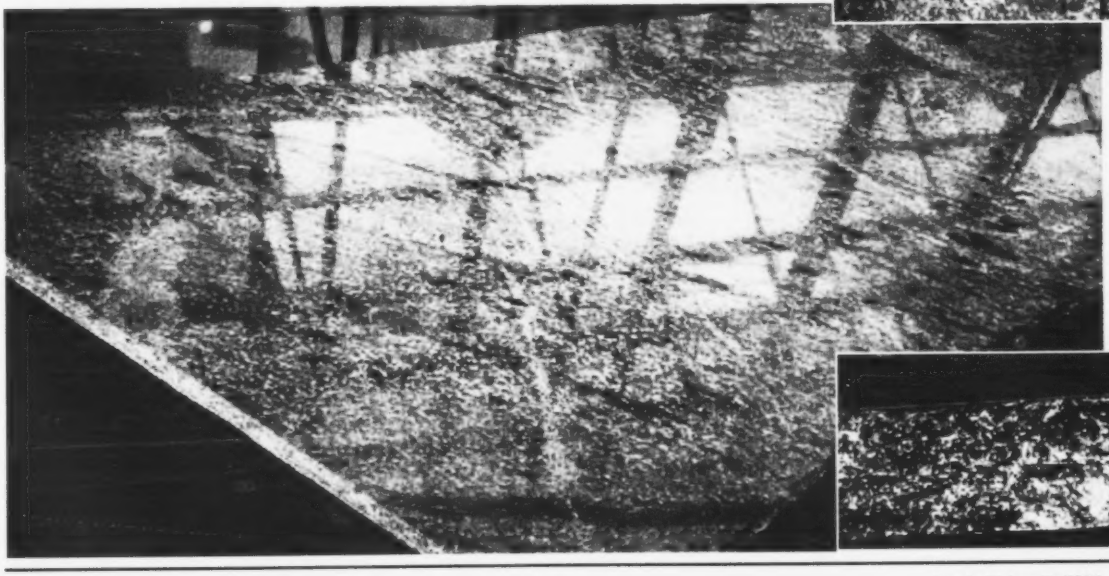
The Fairmont Hotel Macdonald (number 10) was designated as a municipal historical resource by the City of Edmonton in 1985. The skeleton of the hotel is steel and reinforced concrete, which is hidden beneath a skin of Indiana limestone, granodiorite and sheet copper roofing. Throughout the interior of the building, in the floors, walls and furniture, you may also see Carrarra and Lepanto marble, syenite (Blue Pearl) and gneiss.





The Shaw Conference Centre, number 11 on the map, was opened in June 1983. The building has more than 50 000 yards of concrete and is bolted directly into the bedrock as this is the western edge of the 1901 Grierson Hill landslide. The most obvious rock in the building is a large, blue, tabular slab inside the Jasper Avenue entrance, by the pond. The blue mineral is sodalite and the rock is a syenite, a kind of 'no quartz' granite. It is composed of blue sodalite and large blebs of magnetite (metallic grey). The bench below the blue slab is made of a polished black rock with dark plagioclase feldspar and mafics. It is probably diorite.❖





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Metro Toronto Convention Centre
North Building
Toronto, Ontario
Booth 434

CIM Mining Conference and Exhibition 2004
May 9 - 12, 2004
Shaw Conference Centre
Edmonton, Alberta
Booth 1104

Canadian Society of Petroleum Geologists (CSPG) 2004
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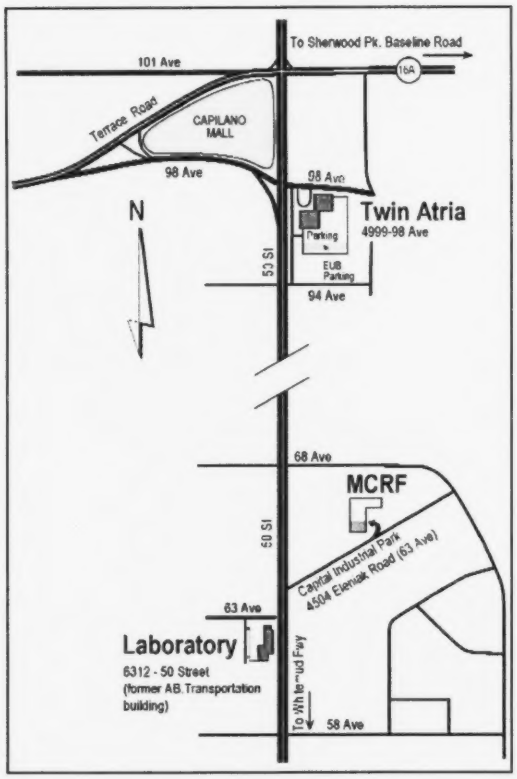
Round Up Centre
Calgary, Alberta

Global Petroleum Show 2004
June 8 - 10, 2004
Stampede Park
Calgary, Alberta

The Thirteenth Annual Calgary Mining Forum and Alberta Geological Survey Minerals Section Open House
March 31 - April 1, 2004
Ramada Hotel
Calgary, Alberta



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The Alberta Geological Survey Library is located at the address above and may be contacted at

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Our Mineral Core Research Facility (MCRF) is located at

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